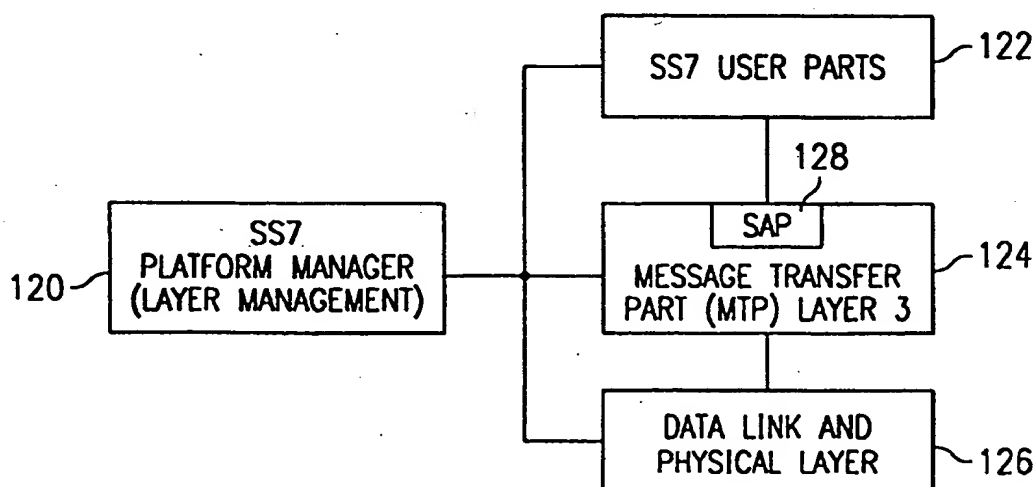


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(54) Title: **HIGH SPEED SS7 SIGNALING ADAPTATION DEVICE**

(57) Abstract

A high speed SS7 signaling adaptation device (200) includes a platform manager (120) having a high speed control interface and operable to configure and monitor the operations of the adaptation device. An SS7 user parts process (122) is in communications with the platform manager (120) and operable to support one or more SS7 user parts protocol, and a message transfer part layer (3) process (124) is in communications with the platform manager (120) and operable to perform message routing, message distribution and message discrimination functions. A data link and physical layer process (126) is further in communications with the platform manager (120) and operable to provide broadband and narrowband SS7 signaling message transport. A plurality of high speed SS7 signaling adaptation devices are distributed in an intelligent telecommunications network. The distributed high speed SS7 signaling adaptation devices are coupled to signal transfer points which are operable to configure, manage and monitor the distributed high speed SS7 signaling adaptation devices.

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HIGH SPEED SS7 SIGNALING ADAPTATION DEVICE

TECHNICAL FIELD OF THE INVENTION

This invention is related in general to the field of telecommunications systems. More particularly, the invention is related to a high speed SS7 signaling adaptation device.

BACKGROUND OF THE INVENTION

As telecommunication networks approach the next century, the ever increasing demand for new services and applications require a rapid expansion of the intelligent signaling and switching networks. In the intelligent network (IN) or advanced intelligent network (AIN), Signaling System Number 7 (SS7) is the signaling protocol for the telecommunications network which is transmitted over 56 or 64 Kbps data links. The SS7 links interconnect signal transfer points (STP), service switching points (SSP), and service control points (SCP) in the typical intelligent network architecture.

The increasing traffic volume of the telecommunications network coupled with new intelligent service offerings result in a bulky SS7 network which may become a troublesome bottleneck that can negatively impact the network's ability to route calls and provide services.

New services, such as local number portability, require a per-call query and response with a network database. These new services are likely to drive current data links to full capacity and introduce additional call set-up delays using the lower speed data links used in today's network. The need for decreasing signaling latency will be of critical importance as end users perceive the quality of service from their chosen carrier.

The signal transfer point performs the message transfer protocol (MTP) routing, management functions for the SS7 user layers and the SCCP (signaling connection control part) functions. The signal transfer points are typically arranged in pairs to provide signaling redundancy for service switching points and for service control points in a typical SS7 network architecture. The SS7 network is integral to call control functions.

SUMMARY OF THE INVENTION

Accordingly, it is desirable to provide a platform and/or an adaptation device that is co-located or integrated with advanced intelligent network nodes which enables SS7 signaling messages to be transported by an asynchronous transfer mode virtual circuit network.

In an aspect of the invention, a high speed SS7 signaling adaptation device includes a platform manager having a high speed control interface operable to configure and monitor the operations of the adaptation device. An SS7 user parts process is in communications with the platform manager and operable to support one or more SS7 user parts protocol, and a message transfer part layer 3 process is in communications with the platform manager and operable to perform message routing, message distribution and message discrimination functions. A data link and physical layer process is further in communications with

the platform manager and operable to provide broadband and narrowband SS7 signaling message transport.

In another aspect of the invention, an intelligent telecommunications network comprises a plurality of signal transfer point, and a plurality of distributed high speed SS7 signaling adaptation devices each being coupled to one of the plurality of signal transfer points and being configured, managed and monitored by the signal transfer points. The intelligent telecommunications network also includes a plurality of intelligent network nodes each coupled to one of the plurality of distributed high speed SS7 signaling adaptation device. A transmission facility having a plurality of asynchronous transfer mode virtual circuits is further coupled to the plurality of signal transfer points and distributed high speed SS7 signaling adaptation devices.

BRIEF DESCRIPTION OF THE DRAWINGS

For a better understanding of the present invention, reference may be made to the accompanying drawings, in which:

FIGURE 1 is a simplified block diagram of an exemplary advanced intelligent network;

FIGURE 2 is diagram of the broadband SS7 layered architecture with the asynchronous transfer mode layer;

FIGURE 3 is a simplified block diagram of major broadband SS7 functional processes in the high speed adaptation device;

FIGURE 4 is a simplified functional block diagram of the high speed adaptation device;

FIGURE 5 is a simplified block diagram of an embodiment of a signaling connection control part process of the SS7 user parts;

FIGURE 6 is a simplified block diagram of an embodiment of an ISDN user part process of the SS7 user parts;

FIGURE 7 is a simplified block diagram of an embodiment of a broadband ISDN user part process of the SS7 user parts;

FIGURE 8 is a simplified block diagram of an embodiment of a message transfer part process;

FIGURE 9 is a simplified block diagram of an embodiment of an SS7 high speed adaptation device coupled to an intelligent network node such as a service switching point and operating within a high speed signaling network;

FIGURE 10 is a simplified block diagram of an embodiment of an SS7 high speed adaptation device operating within a high speed signaling network that is operationally controlled, managed and administered from an off-board system such as a signal transfer point; and

FIGURE 11 is a simplified block diagram of an embodiment of a distributed network signal transfer point where an aggregate of multiple SS7 high speed adaptation devices operating within a high speed signaling network perform the signal transfer point functions, but are controlled by independent off-board systems such as signal transfer points.

DETAILED DESCRIPTION OF THE INVENTION

The preferred embodiments of the present invention are illustrated in FIGURES 1-11, like reference numerals being used to refer to like and corresponding parts of the various drawings.

FIGURE 1 shows an exemplary telecommunications network such as an advanced intelligent network (AIN) or intelligent network (IN). Network 10 includes a service control point (SCP) 14 and a mated pair of signal transfer points (STPs) 16, which are coupled to one another with

SS7 'B' type signaling links. Service control point 14 is directly linked to signal transfer point 106 via an SS7 (signaling system number 7) 'A' type signaling link set 18. An SS7 link set may include up to sixteen signaling data links. Signal transfer points 16 are further coupled to one or more service switching points (SSPs) 22 and 24, via SS7 link sets 20 consisting of 'A' links. Service switching points perform the switching and call handling functions in the network.

Service control point 14 is a transaction based processing system whose primary responsibility is to respond to queries from service switching points 22 for data needed to complete routing a call. Service switching points 22 are part of the public switched telephone network and are coupled to the customer premises equipment (CPE) 28 of telephone service subscribers. Signal transfer points 16 may be coupled to at least one other mated pair signal transfer points 30 via an SS7 link set 32 comprising 'B' type signaling links. Signal transfer points 30 is also coupled to a service control point 33 via 'A' type links and to service switching points 34 via SS7 'A' type link sets 36. A plurality of customer premises equipment 38 are coupled to service switching points 34.

It may be seen that certain SS7 link sets may become points of congestion in the SS7 network 46. For example, SS7 link set 18 between service control point 14 and signal transfer point 16 may be a bottleneck for transporting database queries originating from multiple central offices. As such, the capacity of SS7 link set 18 may severely restrict the service control point's ability to service large volumes of calls. With the offering of new services, often multiple database queries transmitted on links in SS7 network 46 are required to complete a call. For example, service control point 14 provides a centralized database for many services, which includes a local number

portability (LNP) database, a line information database (LIDB), and a calling name (CNAM) database; and signal transfer point 16 may include global title translation (GTT) databases such as an LNP GTT, an LIDB GTT, switch based services GTT, CNAM GTT, local number portability databases and interswitch voice messaging (ISVM) GTT databases containing routing data related to each service.

Similarly, SS7 signaling link set 32 coupling mated pair signal transfer points 16 and 30 may become congested as queries between service control points 14 and 33 are consumed by queries between geographic regions or across network boundaries.

FIGURE 2 is a block diagram showing a combined narrowband and broadband SS7 architecture 60 which provides SS7 interworking functions between narrowband SS7 and broadband SS7. As in the SS7 protocol, broadband SS7 architecture also includes two parts, a message transfer part (MTP) 62 and user parts 64. Message transfer part 62 contains the necessary mechanism to ensure reliable transmission of functional signaling messages with maximum network availability. User parts 64 provide criteria for application and service management. User parts 64 may include ISDN (integrated services digital network) user part (ISUP) 70, narrowband and broadband SCCP 72, TCAP (transaction capabilities application part) (narrowband and broadband) 74, and broadband ISDN user part 76. One of the primary characteristics of broadband SS7 messages is the longer message size - 4096 bytes versus 274 bytes. SCCP 72 and TCAP 74 each contain broadband extensions for compatibility with the broadband message size. B-ISUP 76 differs from ISUP 70 by supporting specific messages and parameters for broadband services as specified by ITU industry standards (Q.2764). Message transfer part 62 of SS7 includes three levels: message transfer part layer 1 80, message transfer part layer 2 82, and message transfer

part layer 3 84. Similarly, message transfer part layer 3 also contains broadband extensions to support broadband services. In broadband SS7 architecture 60, provisions are made for transmitting SS7 signaling over broadband links (OC-3 or STM-1) operating at 155 Mbits/second. This is achieved by replacing SS7 message transfer part layers 2 and 1 with SAAL (signaling ATM adaptation layer) 90, which includes asynchronous transfer mode (ATM) SSCF (service specific coordination function) 92, SSCOP (service specific connection oriented protocol) 94, and ATM adaptation layer 96 (AAL) functionalities. SSCOP is a connection oriented protocol with error recovery providing a generic data transfer service for different ATM adaptation layer services defined by the SSCF. The primary function of the SSCF is to map the services of the SSCOP to the requirements of MTP layer 3. Message transfer part layer 1 80 is replaced by an asynchronous transfer mode layer 98 and an asynchronous transfer mode physical medium dependent layer 100. Message transfer part layer 1 80 includes an interface to V.35/RS-449 narrowband link, and asynchronous transfer mode physical layer 100 includes an interface to a broadband OC-3 or STM-1 link.

Referring to FIGURE 3, the major functional processes of broadband SS7 protocol implementation include an SS7 platform manager 120, an SS7 user parts process 122, a message transfer part layer 3 process 124, and a data link and physical layer process 126. SS7 user parts 122 accesses message transfer part layer 3 124 via a service access point (SAP) 128.

SS7 platform manager 120, also shown in FIGURE 4, is responsible for the configuration and monitoring of a broadband SS7 platform 130 as well as inter-process communications. SS7 platform manager 120 configures the system from configuration files 132, which are read upon start-up of broadband SS7 platform 130. Configuration

files 132 may be modified without interrupting SS7 traffic. A local user interface 134 may also be provided to SS7 platform manager 120 for interactive access to broadband SS7 platform 130. User interface 134 provides local access to the control, statistics and status interfaces for SS7 user parts processes 122, message transfer part layer 3 process 124, and the broadband signaling link components. The SS7 platform manager 120 provides layer management to all the components within the architecture via a layer management messaging protocol.

A control interface (I/F) 136 is coupled to SS7 platform manager 120 to provide an off-board system the capability to control and manage the operations of high speed adaptation device 230. The off-board system has an independent association with the local device and may be a signal transfer point 202 coupled to high speed SS7 adaptation device 230 via a control channel 240, as shown in FIGURE 9. Control channel 240 is described in more detail below.

SS7 user parts process 122 (FIGURE 3) implements the services and applications which broadband SS7 platform 130 supports, which may include ISDN user part, SCCP, TCAP, and broadband ISDN user part. ISDN user part and B-ISDN user part require a service access point layer on a session-by-session basis (see FIGURES 3 and 6-8). Referring to FIGURE 5, SCCP process 140 provides additional functions to the message transfer part layer 3 124 to support connection-less and connection-oriented network services. SCCP process 140 also supports a logical addressing capability among database and intelligent network applications using SS7 network 46 (FIGURE 1). SCCP process 140 acts as a network service provider and provides network subsystem routing for user layers 154, including TCAP 150. SS7 platform manager 120 has configuration and management access to SCCP process 140 layer.

SS7 user parts process 122 also includes a TCAP process 150 depicted in FIGURE 5, which provides a way for intelligent applications to communicate across SS7 network 46 from one application processing platform to a destination application. TCAP process 150 which interfaces with SCCP process 140, may include a programmable application program interface (API) library 152 to enable user applications 154 access to TCAP services.

SS7 user parts 122 may also include an ISDN user part process 160, shown in FIGURE 6. The ISDN user part is a protocol for circuit related messages and is used to set up and tear down all circuits used for data or voice calls in the public switched telephone network. ISDN user part process 160 may interact directly with the message transfer part process 124 instead of using the services of the SCCP. The use of SCCP for ISDN user part 160 is for further study.

Referring to FIGURE 7, a broadband ISDN user part (B-ISUP) process 166 supports broadband ISDN user part through SS7 network 46. Broadband ISDN user part process 166 interfaces with message transfer part process 124 with message transfer part service primitives instead of using the services of SCCP. The use of SCCP for ISDN user part 160 is for further study.

Referring to FIGURE 8, message transfer part layer 3 process 124 implements the message routing, message distribution and message discrimination part of the broadband SS7 platform. Message processing begins in message transfer part layer 3 124. Message transfer part layer 3 124 relies on the services of asynchronous transfer mode data link and physical layer 126 or message transfer part layer 2 and message transfer part layer 1 for delivery of all messages. The interface between the two layers consists of a set of primitives. Message transfer part layer 3 124 also uses primitives to communicate with SS7

user parts 122, i.e., SCCP 140, ISUP 162, and B-ISUP 166. A service access point 128 is established for each session between B-ISUP 166 and message transfer part layer 3 124 and also between ISUP 160 and message transfer part layer 3 124 (shown in FIGURES 6-8). A message transfer part layer 3 API library 170 may be provided for applications who wish to directly access the message transfer part service primitives.

Data link and physical layer process 126 provides the message transfer part layer 3 process 124 with either a narrowband or broadband signaling link. The narrowband signaling link configuration is provided through SS7 message transfer part layers 1 and 2. The broadband signaling link configuration may be provided through SAAL which provides SSCOP and SSCF functionality. Data link and physical layer 126 delivers the message transfer part layer 3 messages. In a narrowband SS7 implementation, message transfer part layer 3 interfaces with a message transfer part layer 2 82 (FIGURE 2). To support the SS7 signaling over an asynchronous transfer mode link the message transfer part layer 3 interfaces with a SAAL (signaling asynchronous transfer mode adaptation layer) 90. However, message transfer part layer 3 accesses the asynchronous transfer mode layer 2 functionality with a set of primitives similar to those used to interface with message transfer part layer 2. Data link and physical layer 126 may have three possible configurations in broadband SS7 platform depending on whether it supports narrowband, broadband signaling links, or both.

Broadband SS7 platform 130 provides narrowband signaling links by integrating message transfer part layer 3 with an message transfer part layer 2 and 1 and ultimately a physical link supporting V.35, RS-449 or DSOA (data service operations and administration interface protocol) physical interfaces. Broadband signaling links

may be provided by integrating the message transfer part layer 3 with SAAL 90 to the OC-3/STM-1 link. SAAL 90 functionality is provided by SSCF and SSCOP.

Constructed in this manner, broadband SS7 platform 130
5 may be used within high speed SS7 signaling adaptation device 230 and operating in signal transfer point 202, service switching point 210 and/or service control point 204 in an SS7 transport scheme shown in FIGURE 9. When implemented as a high speed SS7 signaling adaptation device
10 230, SS7 or other signaling methods may be transported on high speed asynchronous transfer mode links 216.

As shown in FIGURE 3, high speed SS7 signaling adaptation device 230 is coupled to signal transfer point 202 via control channel 240 but does not have to be co-
15 located therewith. Control interface 136 (FIGURES 4 and 8) coupled to control channel 240 provides the capability to control and manage operation of high speed SS7 signaling adaptation device 230 from signal transfer point 202. Control channel 240 provides the control path by which
20 operational commands are sent and received. Status, statistical information and alarm information are communicated from high speed SS7 signaling adaptation device 230. The communications protocol implemented in control channel 240 may be implemented by proprietary
25 message application protocols or from protocols espoused by industry standards bodies. Control channel 240 and the associated message application protocol provides the means to provision and configure this device.

Network redundancy may be achieved through an
30 alternate path to a mated-pair off-board system (signal transfer point 202) as shown in FIGURE 10. Control channel 240 may have redundancy as well. No single point of failure may result in the loss of control channel 240 from signal transfer point 202 assuming high speed SS7 signaling
35 adaptation device 230 is deployed in pairs and

interconnecting SS7 data links from the intelligent network node are replicated to both devices 230.

Referring to FIGURE 11, an aggregate of multiple high speed SS7 signaling adaptation devices 230 are distributed throughout a network that includes intelligent network nodes coupled with a signal transfer point which provides remote operations, administration and management serves to create a network distributed signal transfer point. This network distributed signal transfer point implemented using high speed SS7 signaling adaptation devices 230 employs the full functionality of a stand-alone signal transfer points 202 and 203 as generally defined and/or described by industry requirements and standards. Mated-pair configuration of distributed controlling signal transfer points 202 and 203 may be used to provide system redundancy and integrity system.

High speed SS7 signaling adaptation device 230 may function to provide user applications as shown in the functional user parts process in FIGURE 5. An application program interface 152 permits signaling applications to be developed such that diverse and/or dissimilar signaling protocols which may use SS7 message transfer protocol as an underlying protocol routing layer may be mediated and converted for user part applications 122. Examples of such protocols are ISDN user part, telephony user part (TUP), and broadband ISDN user part. Also the user applications may provide interworking and/or mediation between varying standards bodies such as American National Standards Institute (ANSI), European Telecommunications Standards Institute (ETSI), and the International Telecommunications Union (ITU).

Referring to FIGURES 9-11, concentration devices such as edge multiplexers 220 serve to concentrate and adapt lower speed signals, such as DS0 and DS1, into high speed packets for asynchronous transfer mode transport. SS7

message signaling units (MSUs) are assembled into physical data units (PDUs) and transmitted within standard asynchronous transfer mode packets.

5 The transmission facility includes virtual channels that provide an end-to-end virtual path which may be a permanent virtual circuit (PVC), a soft permanent virtual circuit (SPVC), and/or a switched virtual circuit (SVC). However, the characteristics of SS7 ISUP and SS7 TCAP traffic suggest that when a data link is established, aligned and becomes operational, it generally remains in this state for an extended period of time. Therefore, it is more likely that permanent virtual circuits will be used in network 215 rather than switched virtual circuits though it is a matter of operator choice.

15 The virtual path connection is defined based on the interpretation of the higher layer SS7 message transfer protocol (MTP-3) that includes a destination point code which identifies the physical location of the termination point of the signaling path. Within the virtual path the facility is allocated into multiple virtual channels. The signaling bandwidth of the virtual channel is limited only by the size of the medium or total bandwidth of the physical facility established by industry standards. In this scheme, the broadband asynchronous transfer mode transport does not use point-to-point physical connections, but virtual circuits, whether they may be switched or permanent. This is different from network topologies contemplated by other entities, such as Bellcore. Bellcore has promulgated the *Generic Requirements for CCS Nodes Supporting ATM High-Speed Signaling Links (HSLs)*, GR-2878-CORE, November 1995, which is incorporated herein by reference.

35 Service control point 204 may be coupled to network 215 by an electrical facility (DS-1 or E1) or an optical facility (OC-3 or STM-1) link set 216 using asynchronous

transfer mode signaling to transport SS7. Signal transfer points 202 are coupled to network 215 by optical link sets 216 which may transport asynchronous transfer mode OC-3 or STM-1 format signals. Service switching point 210 may be coupled to network 215 via SS7 adaptation device 200 and edge multiplexer 212 and optical asynchronous transfer mode OC-3 or STM-1 link sets 214. Signal transfer point 203 may also provide physical connectivity for electrical DS-0 (single channel) based SS7 signaling data links 207 and electrical channelized and fractional T1/E1/T3/E3 SS7 signaling data links over a singular transmission facility 209 to legacy network nodes 213, as well as optical SS7 signaling OC-3/STM-1 data links 216 to asynchronous transfer mode network 215. In this manner, signal transfer point 203 supports signaling for both circuit-based and packet-based connectivities.

As specified by industry standards, the link sets in the asynchronous transfer mode SS7 network may have up to 16 links, and load balancing between the 16 links in a link set may be performed with known techniques in the art. Further, any link within a link set may be dynamically loaded with the total capacity of the facility bandwidth to any level of occupancy of the virtual channel so long as the total facility bandwidth has not been exceeded by the total usage of all available channels.

Although the present invention and its advantages have been described in detail, it should be understood that various mutations, changes, substitutions and alterations can be made therein without departing from the spirit and scope of the invention as defined by the appended claims.

WHAT IS CLAIMED IS:

1. A high speed SS7 signaling adaptation device, comprising:

5 a platform manager having a high speed control interface operable to configure, manage and monitor the operations of the high speed SS7 signaling adaptation device;

10 an SS7 user parts process in communications with the platform manager and operable to support one or more SS7 user parts protocol;

a message transfer part layer 3 process in communications with the platform manager and operable to perform message routing, message distribution and message discrimination functions; and

15 a data link and physical layer process in communications with the platform manager and operable to provide broadband and narrowband SS7 signaling message transport.

20 2. The high speed SS7 signaling adaptation device, as set forth in claim 1, wherein the data link and physical layer process further comprises:

25 a signaling asynchronous transfer mode adaptation layer process in communications with the message transfer part layer 3 process for broadband signaling link configuration;

an asynchronous transfer mode layer process in communications with the signaling asynchronous transfer mode adaptation layer process; and

30 an asynchronous transfer mode physical layer process in communications with the asynchronous transfer mode layer process adapted to interface with a physical transmission facility for broadband asynchronous transfer mode SS7 signaling message transport.

3. The high speed SS7 signaling adaptation device, as set forth in claim 1, wherein the data link and physical layer process further comprises:

a message transfer part layer 2 process; and

5 a message transfer part layer 1 process in communications with the message transfer part layer 3 and operable to interface with a narrowband physical transmission facility for SS7 signaling message transport.

10 4. The high speed SS7 signaling adaptation device, as set forth in claim 1, wherein the an asynchronous transfer mode physical layer process is adapted to interface with a physical transmission facility coupled to a virtual circuit network for transporting asynchronous
15 transfer mode SS7 signaling messages.

5. The high speed SS7 signaling adaptation device, as set forth in claim 4, wherein the virtual circuit network comprises permanent virtual circuits.

20 6. The high speed SS7 signaling adaptation device, as set forth in claim 4, wherein the virtual circuit network comprises switched virtual circuits.

25 7. The high speed SS7 signaling adaptation device, as set forth in claim 4, being co-located with a service switching point coupled to the virtual circuit network.

30 8. The high speed SS7 signaling adaptation device, as set forth in claim 4, being implemented in a signal transfer point coupled to the virtual circuit network.

35 9. The high speed SS7 signaling adaptation device, as set forth in claim 4, being implemented in a service control point coupled to the virtual circuit network.

10. The high speed SS7 signaling adaptation device, as set forth in claim 4, being implemented in an advanced intelligent network node coupled to the virtual circuit network.

5

11. The high speed SS7 signaling adaptation device, as set forth in claim 4, being co-located with a legacy network node coupled to the virtual circuit network.

10

12. The high speed SS7 signaling adaptation device, as set forth in claim 1, wherein the SS7 user parts process comprises an ISUP process.

15

13. The high speed SS7 signaling adaptation device, as set forth in claim 1, wherein the SS7 user parts process comprises an SCCP process.

20

14. The high speed SS7 signaling adaptation device, as set forth in claim 1, wherein the SS7 user parts process comprises a TCAP process.

25

15. The high speed SS7 signaling adaptation device, as set forth in claim 1, wherein the SS7 user parts process comprises a broadband ISUP process.

30

16. The high speed SS7 signaling adaptation device, as set forth in claim 1, wherein the data link and physical layer process is operable to interface with at least one electrical DS-0 based SS7 signaling data link via an edge multiplexer.

17. The high speed SS7 signaling adaptation device,
as set forth in claim 1, wherein the data link and physical
layer process is operable to interface with at least one
electrical multi-channel T1 SS7 signaling data link via an
edge multiplexer.

18. The high speed SS7 signaling adaptation device,
as set forth in claim 1, wherein the data link and physical
layer process is operable to interface with at least one
electrical multi-channel E1 SS7 signaling data link via an
edge multiplexer.

19. The high speed SS7 signaling adaptation device,
as set forth in claim 1, wherein the data link and physical
layer process is operable to interface with at least one
optical SS7 signaling data link by SONET or synchronous
digital hierarchy standards.

20. The high speed SS7 signaling adaptation device,
as set forth in claim 1, wherein the data link and physical
layer process is operable to interface with a 16-link link
set.

21. The high speed SS7 signaling adaptation device,
as set forth in claim 20, wherein the data link and
physical layer process is operable to transmit broadband
SS7 signaling messages on one or more links of the 16-link
link set.

22. The high speed SS7 signaling adaptation device,
as set forth in claim 20, wherein the data link and
physical layer process is operable to evenly distribute
broadband SS7 signaling messages on two or more links of
the 16-link link set.

23. The high speed SS7 signaling adaptation device, as set forth in claim 1, further comprising an applications program interface adapted to provide network mediation and protocol conversion.

24. An intelligent telecommunications network, comprising:

a plurality of signal transfer points;

5 a plurality of distributed high speed SS7 signaling adaptation devices each being coupled to one of the plurality of signal transfer points and being configured, managed and monitored by the signal transfer points;

10 a plurality of intelligent network nodes each being coupled to one of the plurality of distributed high speed SS7 signaling adaptation device; and

a transmission facility having a plurality of asynchronous transfer mode virtual circuits coupled to the plurality of signal transfer points and distributed high speed SS7 signaling adaptation devices.

15 25. The intelligent telecommunications network, as set forth in claim 24, wherein the plurality of distributed high speed SS7 signaling adaptation devices each comprises:

20 a platform manager having a high speed control interface operable to configure, manage and monitor the operations of the high speed SS7 signaling adaptation device;

25 an SS7 user parts process in communications with the platform manager and operable to support one or more SS7 user parts protocol;

a message transfer part layer 3 process in communications with the platform manager and operable to perform message routing, message distribution and message discrimination functions; and

30 a data link and physical layer process in communications with the platform manager and operable to provide broadband and narrowband SS7 signaling message transport.

26. The intelligent telecommunications network, as set forth in claim 25, wherein the plurality of distributed high speed SS7 signaling adaptation devices each comprises:

5 a signaling asynchronous transfer mode adaptation layer process in communications with the message transfer part layer 3 process for broadband signaling link configuration;

10 an asynchronous transfer mode layer process in communications with the signaling asynchronous transfer mode adaptation layer process; and

15 an asynchronous transfer mode physical layer process in communications with the asynchronous transfer mode layer process adapted to interface with a physical transmission facility for broadband asynchronous transfer mode SS7 signaling message transport.

27. The intelligent telecommunications network, as set forth in claim 25, wherein the data link and physical layer process further comprises:

20 a message transfer part layer 2 process; and

25 a message transfer part layer 1 process in communications with the message transfer part layer 3 and operable to interface with a narrowband physical transmission facility for SS7 signaling message transport.

28. The intelligent telecommunications network, as set forth in claim 25, wherein the asynchronous transfer mode physical layer process is adapted to interface with a physical transmission facility coupled to a virtual circuit network for transporting asynchronous transfer mode SS7 signaling messages.

29. The intelligent telecommunications network, as set forth in claim 28, wherein the virtual circuit network comprises permanent virtual circuits.

30. The intelligent telecommunications network, as set forth in claim 28, wherein the virtual circuit network comprises switched virtual circuits.

5 31. The intelligent telecommunications network, as set forth in claim 28, wherein at least one of the plurality of distributed high speed SS7 signaling adaptation devices is co-located with a service switching point coupled to the virtual circuit network.

10 32. The intelligent telecommunications network, as set forth in claim 28, wherein at least one of the plurality of distributed high speed SS7 signaling adaptation devices is co-located with a service control
15 point coupled to the virtual circuit network.

20 33. The intelligent telecommunications network, as set forth in claim 25, wherein the SS7 user parts process comprises an ISUP process.

25 34. The intelligent telecommunications network, as set forth in claim 25, wherein the SS7 user parts process comprises an SCCP process.

30 35. The intelligent telecommunications network, as set forth in claim 25, wherein the SS7 user parts process comprises a TCAP process.

35 36. The intelligent telecommunications network, as set forth in claim 25, wherein the SS7 user parts process comprises a broadband ISUP process.

37. The intelligent telecommunications network, as set forth in claim 25, further comprising a concentration device coupled between each of the plurality of distributed high speed SS7 signaling adaptation devices and the intelligent network nodes, the concentration device being adapted to interface the data link and physical layer process with at least one electrical DS-0 based SS7 signaling data link.

38. The intelligent telecommunications network, as set forth in claim 25, further comprising a concentration device coupled between each of the plurality of distributed high speed SS7 signaling adaptation devices and the intelligent network nodes, the concentration device being adapted to interface the data link and physical layer process with at least one electrical multi-channel T1 SS7 signaling data link.

39. The intelligent telecommunications network, as set forth in claim 25, further comprising a concentration device coupled between each of the plurality of distributed high speed SS7 signaling adaptation devices and the intelligent network nodes, the concentration device being adapted to interface the data link and physical layer process with at least one electrical multi-channel E1 SS7 signaling data link.

40. The intelligent telecommunications network, as set forth in claim 25, further comprising a concentration device coupled between each of the plurality of distributed high speed SS7 signaling adaptation devices and the intelligent network nodes, the concentration device being adapted to interface the data link and physical layer process with at least one optical SS7 signaling data link by SONET or synchronous digital hierarchy standards.

41. The intelligent telecommunications network, as set forth in claim 25, further comprising a concentration device coupled between each of the plurality of distributed high speed SS7 signaling adaptation devices and the intelligent network nodes, the concentration device being adapted to interface the data link and physical layer process with a 16-link link set.

42. The intelligent telecommunications network, as set forth in claim 41, wherein the data link and physical layer process is operable to transmit broadband SS7 signaling messages on one or more links of the 16-link link set.

43. The intelligent telecommunications network, as set forth in claim 41, wherein the data link and physical layer process is operable to evenly distribute broadband SS7 signaling messages on two or more links of the 16-link link set.

44. The intelligent telecommunications network, as set forth in claim 25, wherein the high speed SS7 signaling adaptation device further comprises an applications program interface adapted to provide network mediation and signaling protocol conversion.

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FIG. 1

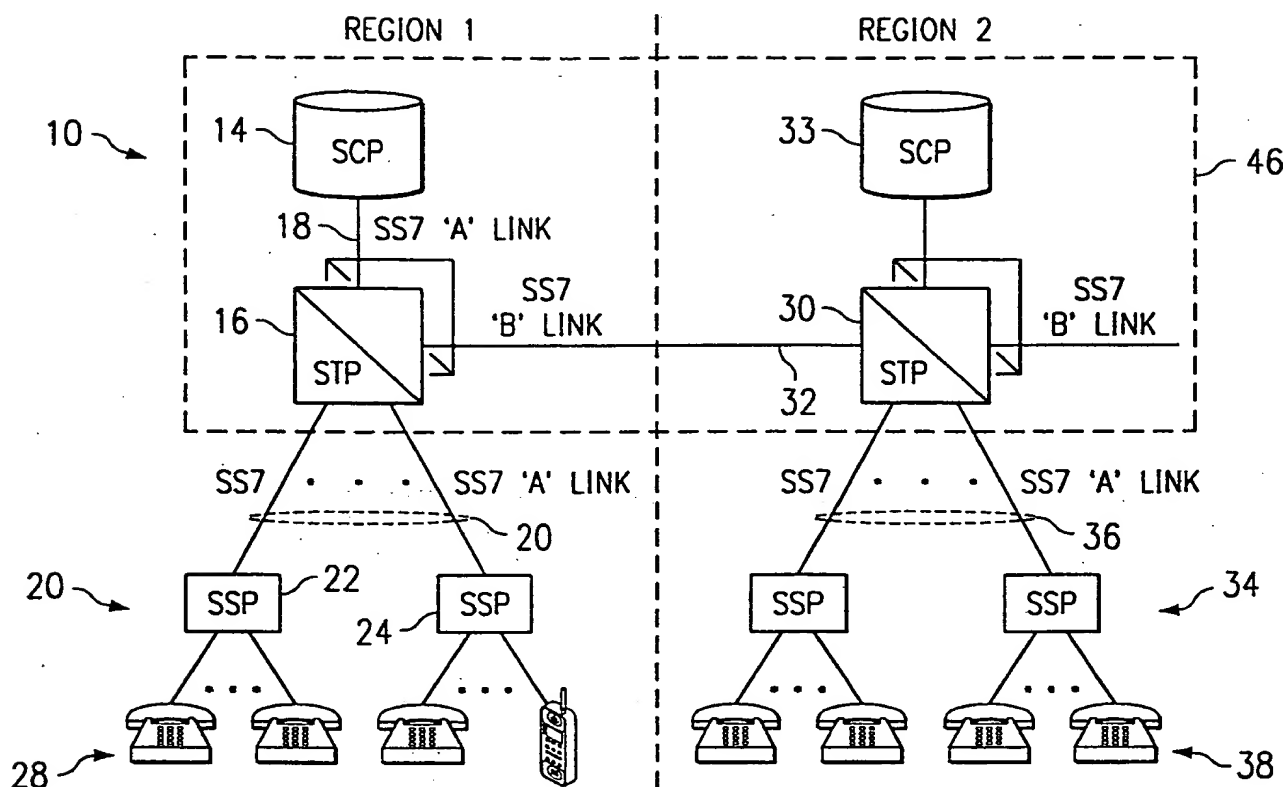
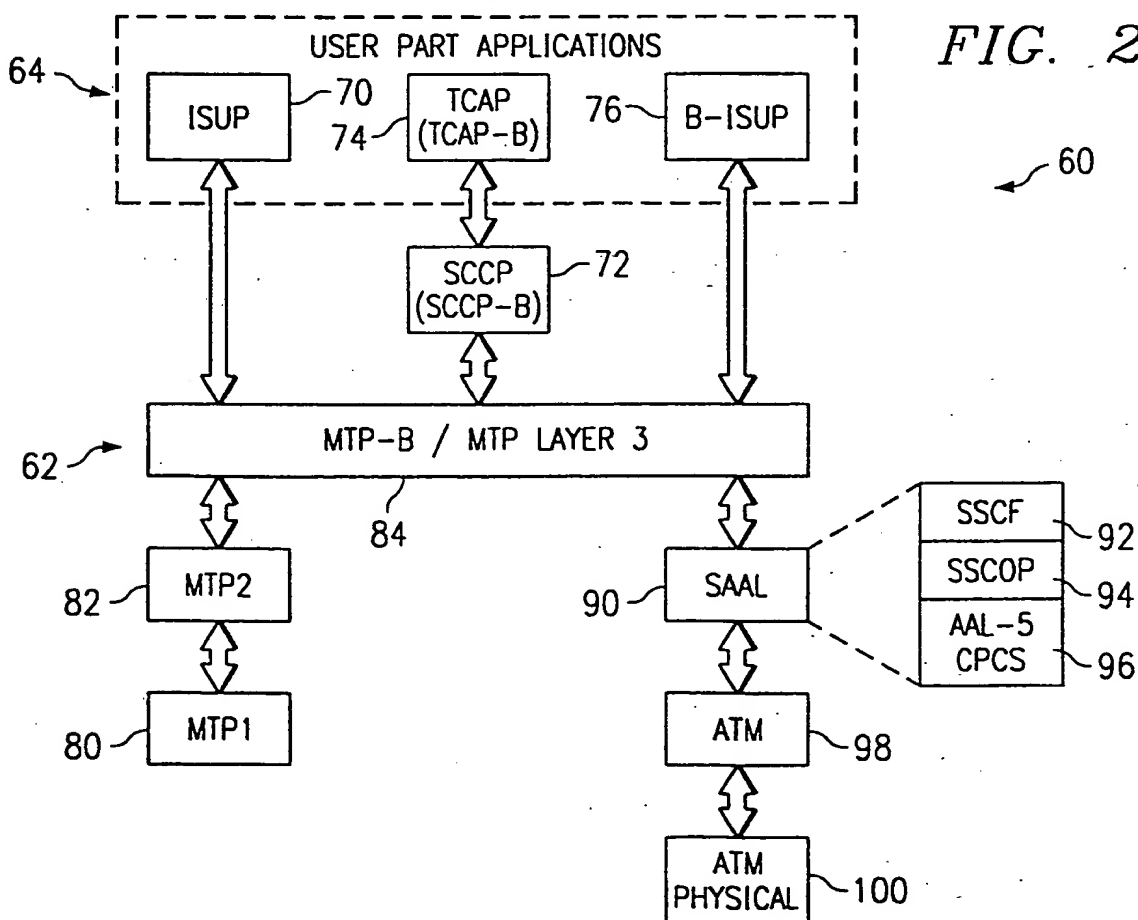


FIG. 2



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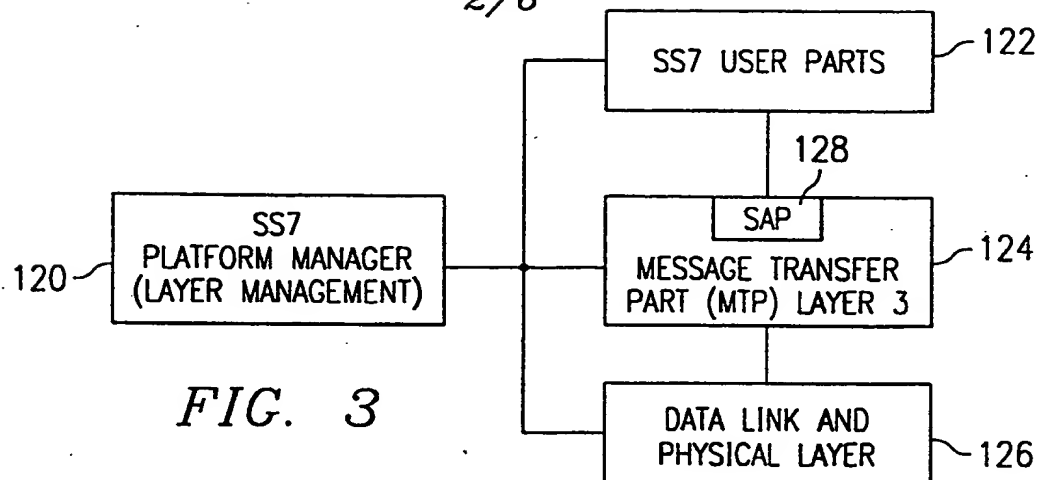


FIG. 3

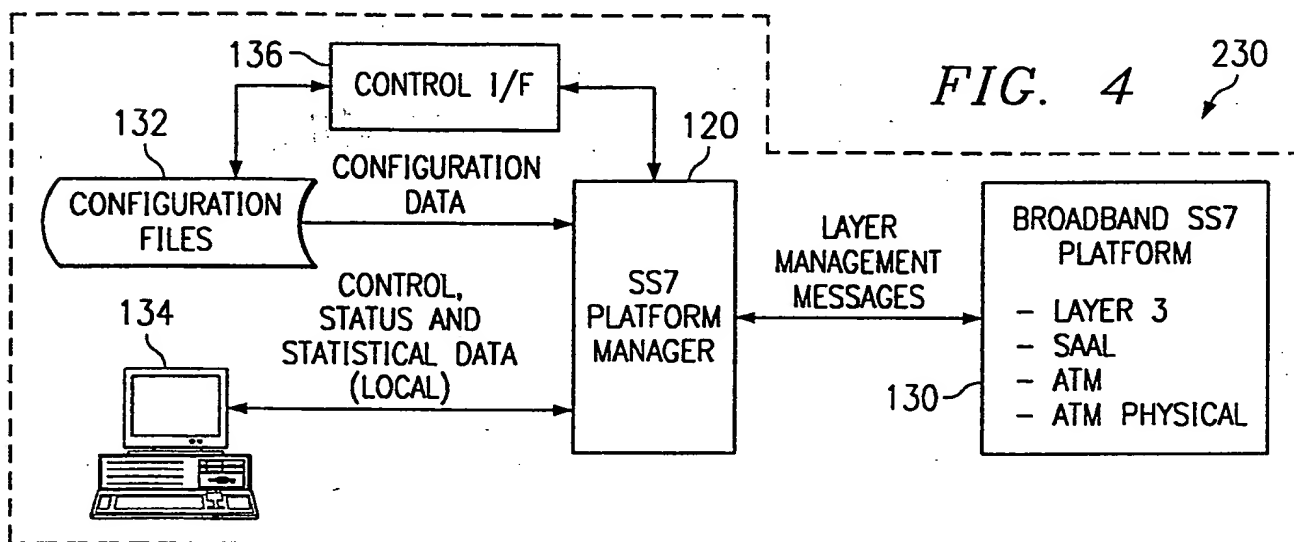


FIG. 4

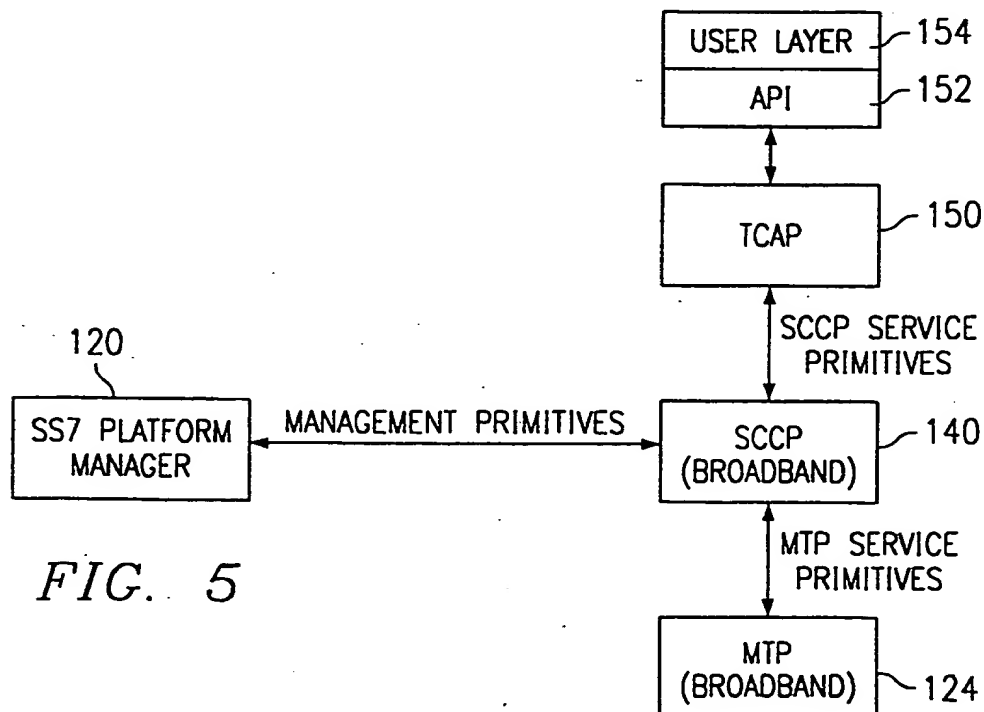


FIG. 5

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FIG. 6

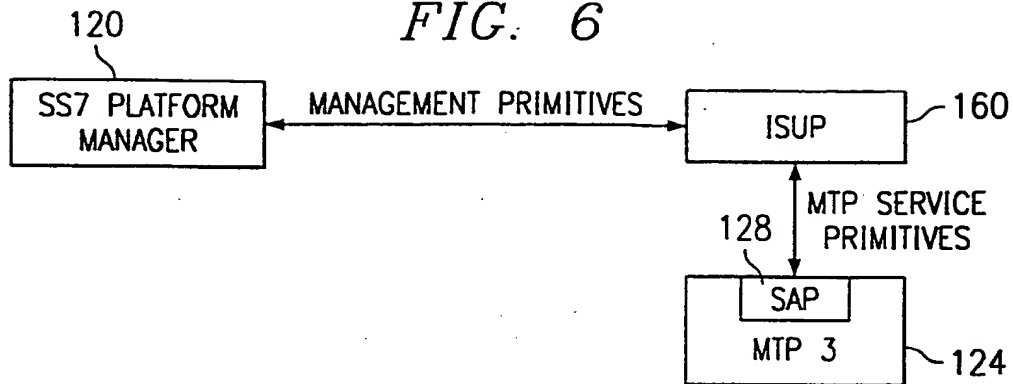


FIG. 7

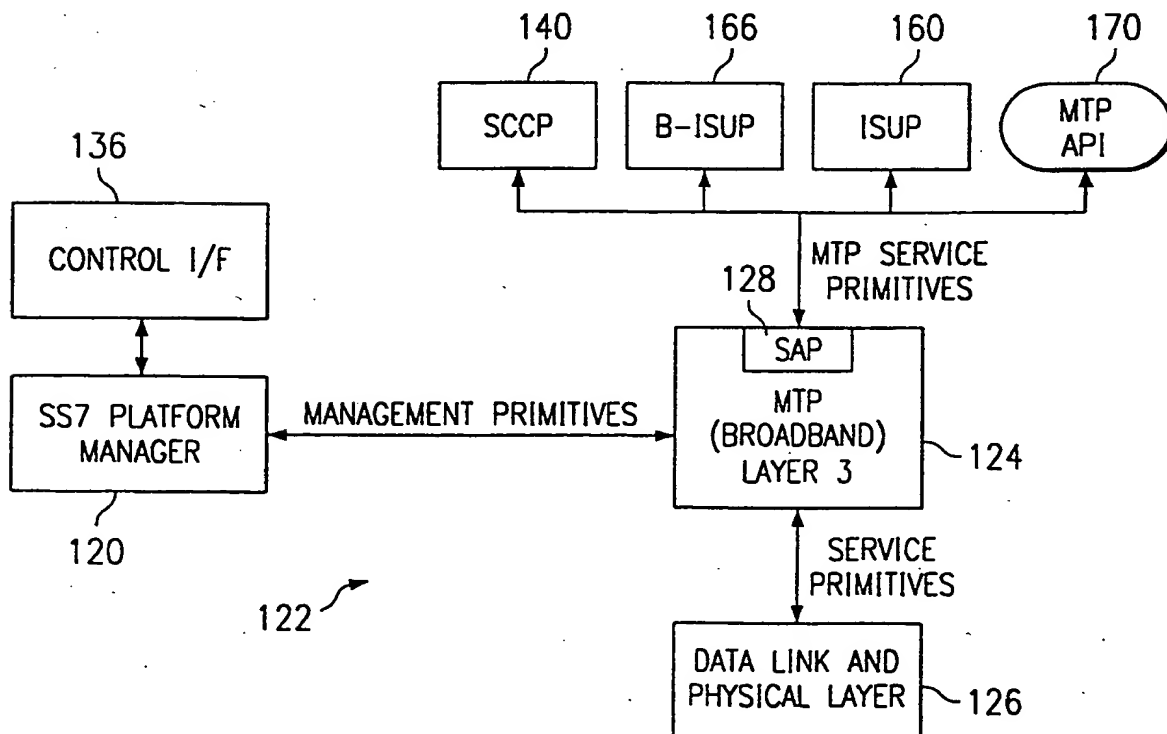
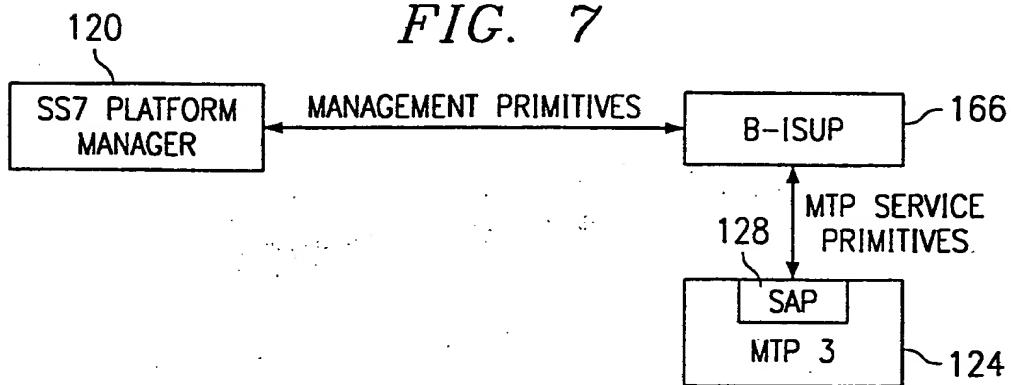


FIG. 8

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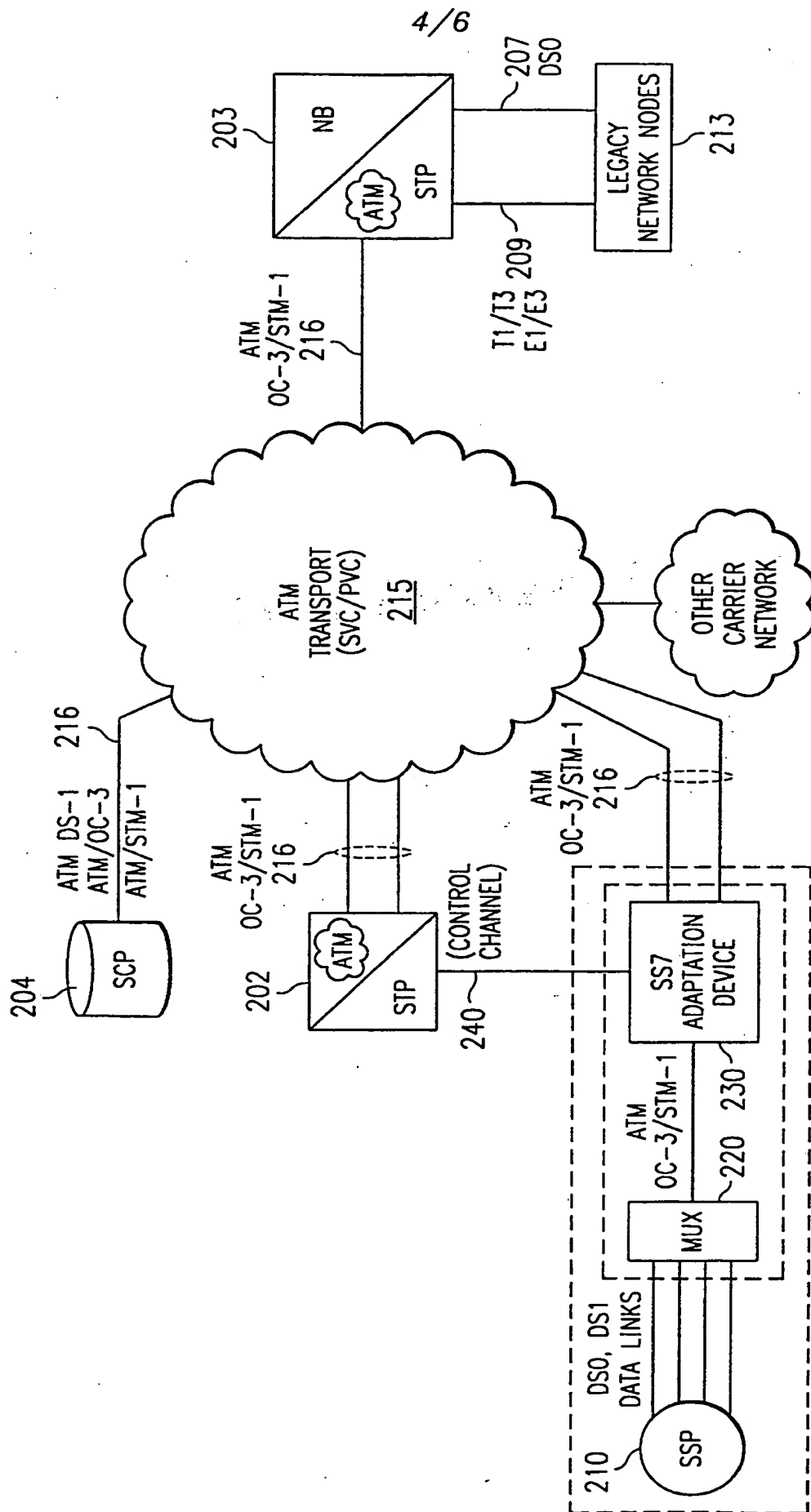


FIG. 9

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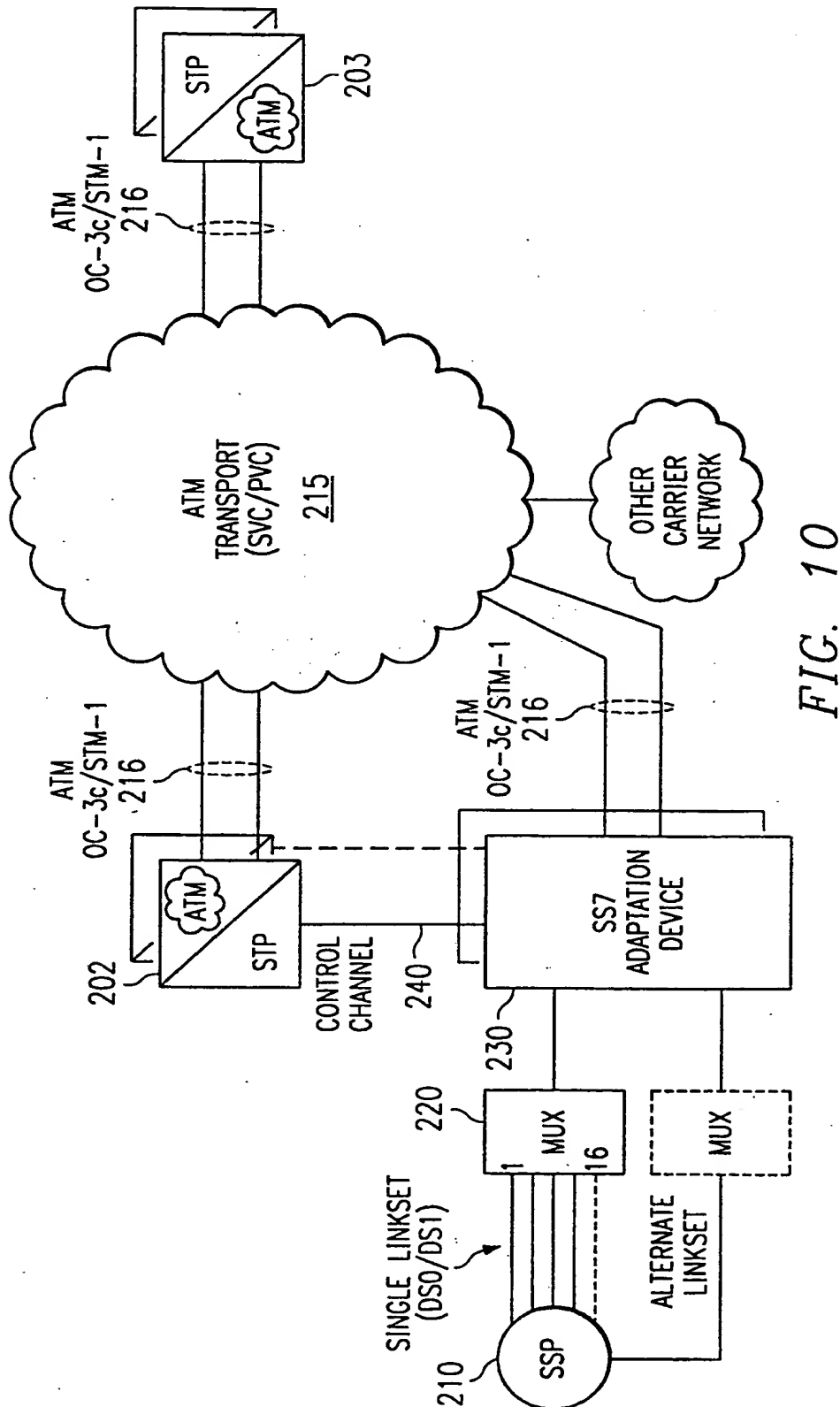


FIG. 10

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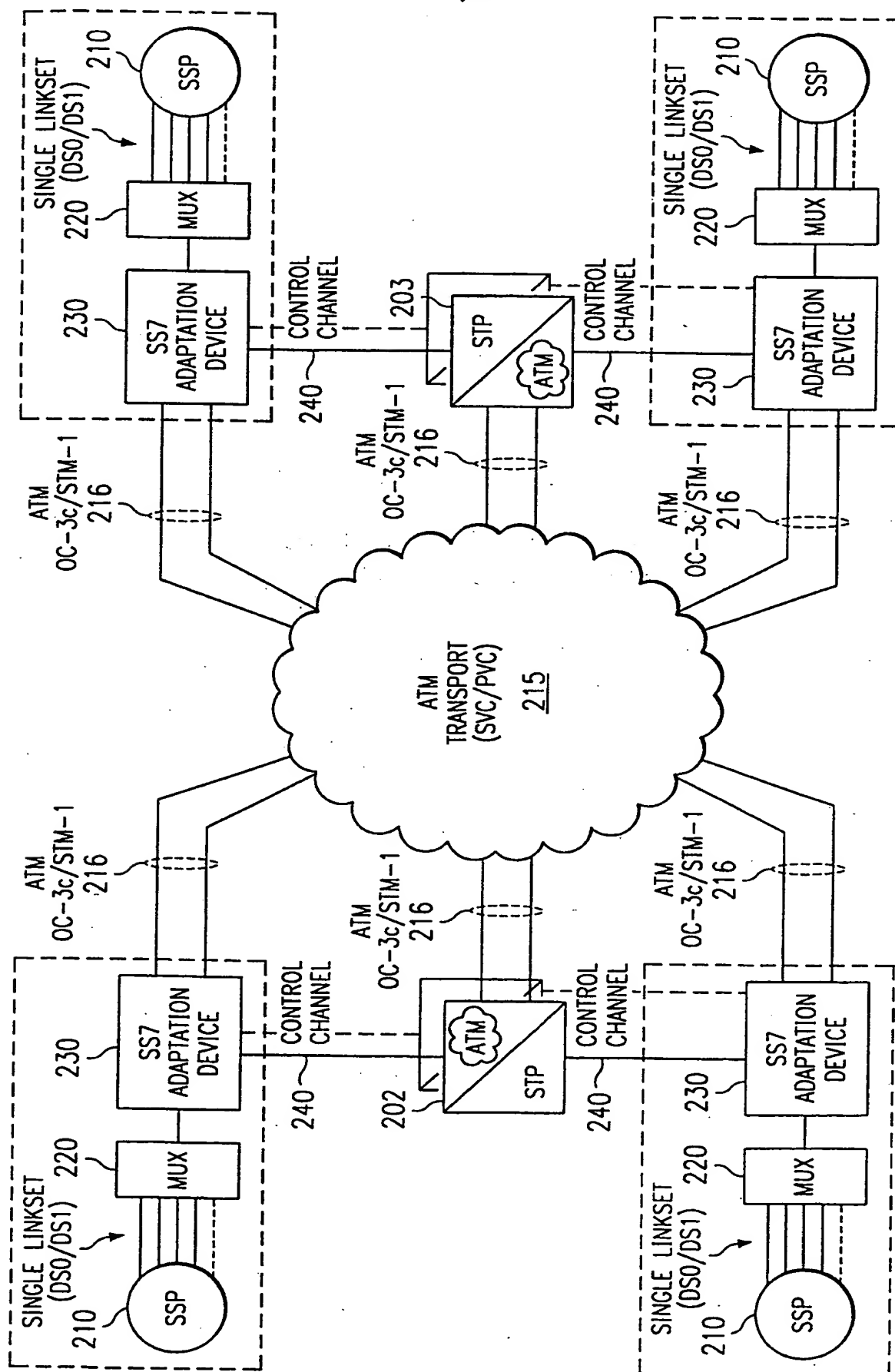


FIG. 11

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INTERNATIONAL SEARCH REPORT

Internatic Application No
PCT/US 98/27878

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 H04Q3/00 H04Q11/04

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 H04Q

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 97 09808 A (SPRINT COMMUNICATIONS COMPANY L.P.) 13 March 1997	1-3, 12, 15-20, 24-27, 33, 36-41
	see abstract	
	see page 3, line 12 - line 19	
	see page 4, line 2 - page 5, line 22	
	see page 6, line 17 - page 7, line 8	
	see page 8, line 8 - page 10, line 15	
A	see page 11, line 23 - line 30	4-11, 28-32
	see figure 2	
	--- -/--	

☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

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Date of the actual completion of the international search

4 June 1999

Date of mailing of the international search report

15/06/1999

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INTERNATIONAL SEARCH REPORT

Internatic Application No
PCT/US 98/27878

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP 0 793 393 A (LUCENT TECHNOLOGIES INC.) 3 September 1997 see abstract see column 3, line 35 - line 49 see column 4, line 31 - line 49 see column 5, line 51 - column 6, line 15 ---	1-44
A	WO 97 28629 A (TELEFONAKTIEBOLAGET LM ERICSSON) 7 August 1997 see abstract see page 4, line 24 - page 5, line 10 -----	1-44

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Information on patent family members

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